2.3 Accomplishments and Issues

D. G. Black

This section describes DOE's progress in meeting its mission at the Hanford Site. Ongoing compliance self-assessments, knowledge gained in implementing Tri-Party Agreement (Ecology et al. 1989) milestones, and communications with stakeholders continue to identify environmental compliance issues. Relevant issues are discussed openly with the regulatory agencies and with the public to ensure that all environmental compliance issues are addressed.

Hanford Federal Facility Agreement and Consent Order

Sixty-four Tri-Party Agreement milestones scheduled for 1996 were completed. Highlights of the work with the associated milestone numbers include the following:

- awarded privatization contracts for the treatment of wastes in 177 underground storage tanks (Milestone M-60-08)
- completed procurement of laboratory services to handle 80% or more of the low-level analytical requirements for the Environmental Restoration/ Waste Management Programs at the Hanford Site (Milestone M-14-04)
- completed vapor characterization for all ferrocyanide Watch List underground waste storage tanks (Milestone M-40-03)
- completed vapor characterization for all organic Watch List underground waste storage tanks (Milestone M-40-08)
- initiated construction of Project W-058 for replacement of the cross-site transfer system for transfer of underground storage tank waste between the 200-East and 200-West Areas (Milestone M-43-07A)
- issued the final environmental impact statement Record of Decision for the Plutonium Finishing Plant (Milestone M-83-01-T01; DOE 1996b)
- completed remediation of 31 waste sites in the 1100 Area (Milestone M-16-05A-T3) (the EPA removed the area from the National Priorities List)
- initiated operation of a 580-L/min (150-gal/min) treatment system for removal of carbon tetrachloride at the 200-ZP-1 Operable Unit in the 200-West Area, treating over 320 million L (83 million gal) of groundwater (Milestone M-16-04A)
- began remedial actions for the 100-BC-1 Operable Unit (Milestone M-16-08A) and 100-DR-1 Operable Unit (Milestone M-16-07A), both in the 100 Areas
- completed construction and initiated operation of the Environmental Restoration Disposal Facility with over 28,000 m^3 (37,000 yd^3) of contaminated soil disposed (Milestone M-70-00)
- issued the *Long-Term Facility Decommissioning Plan* (DOE 1996d; required by Tri-Party Agreement Section 8.3.1)
- issued a revision to the single-shell tank closure work plan in May 1996 (DOE 1996e; in support of Milestone M-45-06 for closure of underground waste storage tanks in the 200 Areas)
- completed all high-priority field investigations in the 100 Areas (multiple Milestone M-15-00 commitments)
- completed design for Project W-178, construction of interim-status tank system upgrades for the 219-S tank system in the 200-West Area (Milestone M-32-02-T01)

- completed construction of the Waste Receiving and Processing Facility, Module 1 in the 200-West Area (Milestone M-18-01)

- completed the pumping of free liquids (interim stabilization) of one single-shell underground waste storage tank (tank T-107 in the 200-West Area, Milestone M-41-27-T01)

- initiated construction of the Sodium Storage Facility at the Fast Flux Test Facility (Milestone M-81-01)

- completed removal of mixed wastes from the 324 Building tanks in the 300 Area (Milestone M-89-01)

- deactivated 22 N Reactor associated facilities, bringing the total to 75 of 83 facilities (no specific milestone: activity supports cleanup goals of the Tri-Party Agreement)

- maintained safe storage of 2,100 metric tons (2,300 tons) of spent fuel from K Basins (no specific milestone: activity supports cleanup goals of the Tri-Party Agreement)

- successfully negotiated the sixth amendment to the Tri-Party Agreement, implementing a single regulator approach to streamline regulatory oversight at Hanford (no specific milestone: activity supports cleanup goals of the Tri-Party Agreement).

Since the last issue of this report, new negotiated changes to the Tri-Party Agreement established 99 new enforceable milestones and 25 new unenforceable target dates.

A summary of the significant changes to the Tri-Party Agreement follows.

Facility Transition Approved Changes

There were two approved change requests related to facility transition during 1996.

The M-82 series of Tri-Party Agreement milestones was created for the B Plant Transition Project. This project's mission is to place B Plant and its ancillary facilities into a safe, environmentally sound, and stable condition that requires minimal long-term surveillance and maintenance. The overall goal of this project is to complete B Plant facility transition (Phase I) by September 1998, and transfer B Plant to the environmental restoration contractor in fiscal year 1999 for cost-effective, long-term surveillance and maintenance. At the completion of Phase I, transition will be complete, necessary preclosure actions will be complete and/or approved, and Phase II (surveillance and maintenance) will begin. Transition of B Plant will result in a reduction of the hazards and risks associated with these facilities until the facility disposition phase (Phase III) is initiated. When transition is completed, it is expected that funds (no longer needed at B Plant) will be available for other site environmental management activities.

Interim milestone M-20-21A was revised, replacing the requirement for B Plant to prepare and submit a Resource Conservation and Recovery Act Part B permit application with the requirement to submit a B Plant preclosure work plan. This action is appropriate for the facility because it has no future mission.

Waste Management Program Approved Changes

The M-19 milestones were revised. This change is an alternative to constructing and operating the waste receiving and processing 2A facility on the Hanford Site. The revised strategy employs several parallel paths to accomplish the facility's mission for treating contact-handled (material that can be handled nonremotely) low-level mixed waste. The new milestones require that waste treatment and/or direct disposal begin by the planned date and continue at a rate equaling or exceeding the rate previously planned for the facility. A new major milestone established this treatment/disposal rate as a requirement through fiscal year 2002.

Milestone M-33-00 was established to 1) prompt the development of milestones necessary for the storage, treatment/processing, and disposal of Hanford Site solid wastes and hazardous materials not yet covered under the agreement and 2) prompt the development and incorporation of agreement modifications designed to aid in achieving integrated management of all aspects of Hanford Site cleanup (including but not limited to waste and materials management, remedial action, and site closure).

To meet these objectives, the parties negotiated agreement modifications in 1996 under change request numbers L-96-01, M-90-96-01, M-91-96-01, and M-92-96-01.

The changes reflect the parties recognition that effective management of Hanford cleanup and waste and materials management demands a fully coordinated approach. In addition, these changes have been developed recognizing that a number of Hanford's special nuclear materials may no longer be needed for their original purposes and have no clearly identified future use. Specific waste/materials project management milestones were established under new major milestones M-90-00, M-91-00, and M-92-00.

Milestone M-90-00 and its subelements govern the acquisition of new facilities, modification of existing facilities, and/or modification of planned facilities necessary for the interim storage of Tank Waste Remediation System high-level waste and other high-level waste forms in canisters and for interim storage and disposal of low-activity waste.

Milestone M-91-00 and its subelements govern the acquisition of new facilities, modification of existing facilities, and/or modification of planned facilities necessary for the storage, processing, and disposal of Hanford Site transuranic waste, low-level mixed waste, and greater-than-category 3 waste. (Greater-than-category 3 refers to waste exceeding certain established radioactivity limits for disposal.)

Milestone M-92-00 governs the acquisition of new facilities, modification of existing facilities, and/or modification of planned facilities necessary for the storage, treatment/processing, and disposal of Hanford Site cesium and strontium capsules, unirradiated uranium, bulk sodium, and 300 Area special case waste (a category of miscellaneous wastes).

Tank Waste Remediation System Approved Changes

DOE completed an analysis of privatization of low-activity waste pretreatment and immobilization options for cleanup of the radioactive and hazardous tank wastes in the single- and double-shell underground storage tanks at Hanford. The Tank Waste Remediation System mission is to conceptualize, develop, design, construct, and operate the physical systems and technologies necessary to retrieve waste from these 177 tanks located in the 200-East and 200-West Areas and convert the waste into a solid suitable for ultimate disposal. Under the privatization approach, private companies under contract with DOE will treat Hanford's tank wastes and return a treated product to DOE.

Pollution Prevention Program

The Hanford Site Pollution Prevention Program is a combination of three programs developed and maintained by their respective contractors: Bechtel Hanford, Inc., Pacific Northwest National Laboratory, and Fluor Daniel Hanford, Inc. The program is an organized, comprehensive, and continual effort to systematically reduce the quantity and toxicity of hazardous, radioactive, mixed, and sanitary wastes. Also, the program fosters the conservation of resources and energy, the reduction of hazardous substance use, and the prevention or minimization of pollutant releases to all environmental media from all operations and site cleanup activities.

The program is designed to satisfy DOE requirements, executive orders, and state and federal regulations and requirements. In accordance with sound environmental management, preventing pollution through source reduction is the first priority in this pollution prevention program, and the second priority is environmentally safe recycling. Waste treatment to reduce quantity, toxicity, or mobility (or a combination of these) will be considered only when prevention and recycling are not possible or practical. Environmentally safe disposal is the last option.

Hanford Site pollution prevention efforts in 1996 helped to prevent the generation of 2,900 m^3 (3,800 yd^3) of radioactive mixed waste, 174 metric tons (191 tons) of Resource Conservation and Recovery Act hazardous/dangerous waste, 342 million L (90 million gal) of process waste water, and 12,600 metric tons (13,800 tons) of sanitary waste. Total savings in 1996 exceeded $15,600,000 for these activities.

During 1996, the Hanford Site recycled 595 metric tons (655 tons) of office paper, 57 metric tons (62 tons) of cardboard, 2,000 metric tons (2,200 tons) of ferrous metal, 175 metric tons (190 tons) of nonferrous metal, 21 metric tons (23 tons) of lead, 22 metric tons (24 tons) of solid chemicals, 86,000 L (23,000 gal) of liquid chemicals, 200 kg (440 lb) of aerosol cans, 8,400 kg (18,500 lb) of fluorescent light tubes, and 48,000 kg (105,000 lb) of lead acid/gel cell batteries. Savings in 1996 exceeded $1,750,000 based on disposal costs.

Numerous generator-specific initiatives were put into place that enabled these waste reductions and cost savings. To celebrate these pollution prevention activities, the "Hanford Pollution Prevention Accomplishments Book" (Olsen 1996) was published in September 1996. The

book outlines 45 initiatives that were implemented and are now in use at locations throughout the Hanford Site.

Environmental and Molecular Science Laboratory

In October 1996, the Environmental and Molecular Science Laboratory was officially dedicated by Secretary of Energy Hazel O'Leary as the William R. Wiley Environmental and Molecular Science Laboratory. This dedication highlighted a year where construction neared completion. Major pieces of research equipment were received and installed in the facility, including a new state-of-the-art computing system and an ion accelerator. The movement of staff into the facility is scheduled to begin in early spring 1997, which will commence the beginning of research activities in this new facility. When finished, the 18,600-m^2 (200,200-ft^2) facility will accommodate up to 270 permanent staff, visiting scientists, postdoctoral researchers, and students who will work to develop the science and technology needed to clean up environmental contaminants at government and industrial sites across the country.

The city of Richland issued an industrial waste-water permit (CR-IU005) to DOE that allows for process waste water from the laboratory to be discharged to the city of Richland's publicly owned treatment works. The permit was issued in accordance with the provisions of city ordinances in October 1996 and expires in October 2001. The discharge permit requires monthly effluent monitoring and reporting of the analytical data to the city. Additionally, as required by the permit, an accidental spill prevention plan was developed and submitted to the city. This plan describes measures taken to prevent, control, and mitigate the effects of accidental releases of hazardous materials from the laboratory to the city.

Spent Fuel Project Activities

In February 1994, the Spent Nuclear Fuel Project was established to provide safe, economic, and environmentally sound management of Hanford spent nuclear fuel in a manner that stages it to final disposition.

The Hanford Site spent nuclear fuel inventory constitutes approximately 80% of the inventory currently stored across the national DOE complex. The majority of Hanford's inventory consists of approximately 2,100 metric tons (2,300 tons) of irradiated N Reactor fuel stored in the K Basins.

In 1996, the project continued to make progress on its accelerated strategy for moving the wet-stored K Basin fuel away from the Columbia River and into a new dry storage facility in the 200-East Area (the Canister Storage Building). Construction of the building is in progress; the walls of all three below-grade vaults were completed in 1996. As construction continues, designs are being finalized and fabrication and construction activities on other parts of the project are being started. The cold vacuum drying process is an example. With the help of our stakeholders, a site for the process was selected, and site grading was completed. Construction of the building is scheduled to begin in early 1997.

Facility Stabilization Project

The Facility Stabilization Project mission is to transfer those Hanford facilities for which it has responsibility from an operating mode to a long-term surveillance and maintenance mode. This includes providing for the safe storage of nuclear materials and reducing risks from hazardous materials and contamination. Under the project, the deactivation of primary systems to effectively reduce risks to human health and the environment will also be conducted. These activities will allow the lowest surveillance and maintenance cost to be attained while awaiting determination of a facility's final disposition and possible turnover to the DOE Headquarters Environmental Restoration Program.

Section 8.3.1 of the Tri-Party Agreement requires DOE to submit a long-term facility decommissioning plan to the Washington State Department of Ecology and the EPA. This plan provides a mechanism by which the three parties will address decommissioning of existing and future facilities on the Hanford Site. The plan was issued as required (DOE 1996d) and identified key and nonkey facilities. For the key facilities, a long-term "road map" showed the approximate time periods that the key facilities would undergo transition, surveillance and maintenance, and/or final disposition. The road map is for use by the three parties to assist in the planning process to integrate and prioritize work.

Currently, the Facility Stabilization Project is engaged in five major deactivation projects at Hanford. Each is in a

different stage of completion and each presents a host of technical and management challenges. The major projects are the Plutonium-Uranium Extraction Plant, the Plutonium Finishing Plant, B Plant/Waste Encapsulation and Storage Facility, 300 Area Stabilization, and the Advanced Reactors Transition. The mission of each program and its accomplishments during 1996 are summarized below.

Plutonium-Uranium Extraction Plant

The mission of the Plutonium-Uranium Extraction Deactivation Project is to transition the facility to a long-term, low-cost surveillance and maintenance state that is safe and environmentally secure. This deactivation will remove, reduce, and/or stabilize the radioactive sources and hazardous substances within the complex in a safe, cost-effective manner, with a goal of becoming a model for future facility transition projects. When transition is complete, the plant will be left unoccupied and locked, pending eventual decontamination and decommissioning.

The schedule for completion of this deactivation has been accelerated from the original date of October 1997 to May 1997. During the course of 1996, major progress was made toward support of the accelerated completion date, including transfer of nuclear material, reclassification of the facility from "fissile" to "limited control," and deactivation of the criticality alarm system.

Additional stabilization activities in 1996 involved the removal of 60,000 L (16,000 gal) of organic solvent. This followed the recovery and sale of 700,000 L (180,000 gal) of nitric acid in 1995. Other activities in 1996 included the disposal of the residual uranium removed from the acid as well as flushing of canyon vessels. Facility modifications included the shutdown of the steam supply system; isolation of the canyon; and sealing all routes to underground storage tanks, cribs, and ponds. The ventilation and filtering system was reconfigured, and a new electrical distribution system was installed to support long-term facility surveillance. Additionally, the over 100 metric tons (110 tons) of remaining depleted uranium oxide at the Uranium TriOxide Plant in the 200-West Area were removed and disposed.

Plutonium-Uranium Extraction Plant staff provided orientation and training to future surveillance and maintenance personnel and hosted deactivation technical exchanges to share information and "lessons-learned." During 1996, Plutonium-Uranium Extraction Plant personnel met all Tri-Party Agreement milestones ahead of schedule and under budget (the multiyear project is approximately $20 million under budget).

Plutonium Finishing Plant

The Plutonium Finishing Plant mission is to stabilize, repackage, immobilize, and/or properly dispose of plutonium-bearing materials in the plant; to deactivate the processing facilities; and to provide for the safe and secure storage of special nuclear materials until final disposition.

During 1996, the Plutonium Finishing Plant's environmental impact statement Record of Decision was approved (61 FR 36352). The Record of Decision provides the DOE's decision to implement a select group of alternatives for removing readily retrievable material held up in equipment, piping, etc., from the facility and for stabilizing or cementing stored and retrievable plutonium-bearing material.

Stabilization activities included the sale of 12,000 L (3,200 gal) of concentrated nitric acid; the transfer of 28,000 L (7,400 gal) of aluminum nitrate nanohydrate to the Idaho National Engineering and Environmental Laboratory; and the transfer of approximately 9,500 L (2,500 gal) of sodium hydroxide to underground double-shell waste storage tanks in the 200 Areas. Also during 1996, approximately 900 items from earlier facility cleanout efforts were encapsulated in cement for disposal; approximately 100 items from the plutonium storage vault were repackaged; 52 items of reactive plutonium-bearing ash materials were thermally stabilized and packaged for interim safe storage; and approximately 220 kg (485 lb) of sand, slag, and crucible material were encapsulated in cement for disposal.

Facility activities included cleanout and removal of plutonium-contaminated ductwork and flushing and isolation of chemical storage and processing tanks.

Engineering studies and development tests were performed in 1996 to validate the technology and safe operating criteria for solution stabilization activities, including testing of a prototype direct denitration calciner for conversion of plutonium nitrate solutions to stable plutonium dioxide powder. Construction and startup of a full-scale operating calciner is scheduled for 1997.

Preliminary planning was initiated in 1996 to support deactivation of the processing areas of the plant once

stabilization activities have been completed. A deactivation plan was completed for the Plutonium Reclamation Facility, and a deactivation program management plan for the Plutonium Finishing Plant is scheduled to be completed in 1997.

A Resource Conservation and Recovery Act closure plan was developed and submitted to the Washington State Department of Ecology to support the eventual closure of the 241-Z Treatment and Storage Facility.

While stabilization and deactivation planning activities were ongoing, efforts to ensure the safe and secure storage of special nuclear materials continued. Modifications to plant systems were made to facilitate international safeguards under the auspices of the International Atomic Energy Agency. Additional efforts were made to characterize vault inventories and to develop a material storage container compatible with long-term storage standards.

B Plant/Waste Encapsulation and Storage Facility

The B Plant Project mission is to deactivate the facility and place it into a configuration suitable for long-term surveillance.

During 1996, planning for accelerated deactivation of B Plant was completed. Transition documents, such as the end point criteria document and the project management plan, were prepared. Key milestones were negotiated with the Washington State Department of Ecology in accordance with the Tri-Party Agreement.

Facility deactivation activities began in earnest in 1996 with removal of regulated liquids from all 100 chemical feed tanks in B Plant and the isolation of 77 of 86 canyon tanks and 40 of 44 operating gallery tanks completed. All clean bulk chemicals were excessed or disposed of, including 53,000 L (14,000 gal) of sodium hydroxide and 6 metric tons (6.6 tons) of sodium nitrite. Outdoor radiological areas were reduced by more than 4,600 m^2 (5,500 yd^2).

Chemical washing of 38,000 L (10,000 gal) of process solvent was completed, reducing the radiological contamination (over 70,000 Ci removed) and allowing the liquid to be removed from the facility. Removal of this flammable liquid, in turn, allowed some 20 operational systems required for the safe storage of these solvents to be deactivated, reducing annual maintenance and surveillance costs by $2 million.

The Waste Encapsulation and Storage Facility Project mission is to provide safe interim storage of encapsulated radioactive material. Facility systems and structures are being upgraded to ensure their continued future operability.

During 1996, 25 cesium capsules from offsite were returned and consolidated at the Waste Encapsulation and Storage Facility. Work was initiated on replacement of the cooling system and installation of other systems required to provide services that had historically been obtained through B Plant, thus developing the Waste Encapsulation and Storage Facility into a fully operational stand-alone facility.

300 Area Stabilization

The 300 Area Stabilization Project currently has two subprojects: 1) 300 Area Fuel Supply Shutdown and 2) 324/327 Buildings Facilities Transition. The mission of the fuel supply shutdown subproject is to complete deactivation and closure activities while maintaining the complex in compliance with regulations until turnover to the DOE Headquarters Environmental Restoration Program.

During 1996, major reductions of accumulated low-level waste and areas of contamination were accomplished in the fuel supply shutdown subproject. A second Resource Conservation and Recovery Act clean closure was completed with the Washington State Department of Ecology's acceptance of the 304 Concretion facility documentation. Over 700 metric tons (770 tons) of uranium billets were packaged and shipped to the United Kingdom. Phase I of building shutdown and stabilization was completed at the 304 and 303-M buildings and the 311 Material Transfer facility. Also a major task of excessing spare parts and nuclear materials from fuel supply shutdown facilities was completed during 1996.

The 324/327 Buildings were transferred to the Facility Stabilization Project in November 1996. These facilities are involved in selected stabilization activities in response to Tri-Party Agreement milestones (B cell clean out and high-level vault tank closures) and the vulnerability assessments (cesium capsule removal and legacy fuel removal). Transition documents, including an end point criteria document and a deactivation project management plan, are being developed to guide future deactivation activities.

During 1996, a Resource Conservation and Recovery Act closure plan was submitted to the Washington State

Department of Ecology and waste removal from the 324 facility's high-level vault tank system was completed (both Tri-Party Agreement milestones), including treatment and disposition of the waste. Removal of highly radioactive dispersible waste from the 324 Building was also completed.

Advanced Reactors Transition

The Advanced Reactors Transition Project has three subprojects: 1) Fast Flux Test Facility, 2) Fuels and Materials Examination Facility, and 3) Nuclear Energy and Plutonium Recycle Test Reactor/309 Building. The mission of the Advanced Reactors Transition Project is to safely transition these facilities to a deactivated state.

In November 1995, DOE revised its direction to the facility stabilization project related to the Fast Flux Test Facility, halting any irreversible deactivation activities and, in January 1997, direction was received to place the facility in "hot standby" while alternative future missions for the reactor are explored (i.e., medical isotope and/or tritium production). A decision on the Fast Flux Test Facility's future is expected in December 1998.

Construction was completed on the Sodium Storage Facility, intended for storage of Fast Flux Test Facility coolant, in October 1996. Sodium will not be transferred to this facility in the near future, pending the outcome of the 1998 decision on the future of the plant.

Fast Flux Test Facility deactivation activities completed in 1996 included removal of over 60 highly radioactive fuel components, washing and placing the components in interim storage casks, and transporting the casks to the 400 Area interim storage area. Additionally, reactor vessel immersion heaters were installed and three polychlorinated biphenyl transformers were removed.

Nuclear fuel was removed from the 308 Building (a DOE Nuclear Energy Program subproject), and deactivation activities for this building were completed. Nuclear Energy Program legacy test loop piping and hardware removal was completed from the 335 and 335-A Buildings.

Cleanout of the 309 Building (Plutonium Recycle Test Reactor) rupture loop ion exchange vault was completed, and characterization was performed on the rupture loop annex.

A Resource Conservation and Recovery Act partial clean closure was completed for the 105-DR Large Sodium Fire Facility in 1996. This facility is in the process of being transitioned to the DOE Headquarters Environmental Restoration Program for final disposition. Resource Conservation and Recovery Act closures were also completed for the 4843 Alkali Metal Storage Facility and the 3718-F Alkali Metal Treatment and Storage Facility. The 4843 closure is awaiting acceptance by the Washington State Department of Ecology. Soil sampling still needs to be performed in the vicinity of 3718-F prior to final closure certification for that facility.

Sodium test loops in the 300 Area were dismantled as part of the DOE Nuclear Energy Program Legacy Program in 1996. Approximately 600 L (160 gal) of nonradioactive elemental sodium was transferred to an offsite vendor. This program will continue in 1997.

Tank Waste Remediation System Activities

Waste Tank Status

The status of the 177 waste tanks as of December 1996 was reported in Hanlon (1997). This report is published monthly; the December report provided the following:

- number of waste tanks
  - 149 single-shell tanks
  - 28 double-shell tanks

- number of tanks listed as "assumed leaker" tanks
  - 67 single-shell tanks
  - 0 double-shell tanks

- chronology of single-shell tank leaks
  - 1956: first tank reported as suspected of leaking (Tank 241-U-104)

  - 1973: largest estimated leak reported (Tank 241-T-106; 435,000 L [115,000 gal])

  - 1988: tanks 241-AX-102, -C-201, -C-202, -C-204, and -SX-104 reported as confirmed leakers

  - 1992: latest tank (241-T-101) added to assumed leaker list, bringing total to 67 single-shell tanks

  - 1994: tank 241-T-111 declared an assumed re-leaker

- number of ferrocyanide tanks on the Watch List
  - 0 (all 18 single-shell tanks were removed from the Watch List in 1996)

- number of flammable gas tanks on the Watch List
  - 19 single-shell tanks
  - 6 double-shell tanks

- number of organic tanks on the Watch List
  - 20 single-shell tanks.

So far, 115 single-shell tanks have been stabilized, with the tank stabilization program to be completed in 2000. At the end of 1996, 108 single-shell tanks had intrusion prevention devices completed, and 51 single-shell tanks were disconnected and capped to avoid inadvertent liquid additions to the tanks.

The total estimated volume to date of radioactive waste leakage from single-shell tanks is 2.3 million to 3.4 million L (600,000 to 900,000 gal).

During 1996, pumping occurred in six single-shell tanks. Portions of Tanks 241-T-104, T-107 (which was declared stabilized when pumping was completed), T-111, S-108, S-110, and BY-109 were pumped.

During 1996, the BX, TX, and TY Tank Farms were declared controlled, clean, and stable. Controlled, clean, and stable means that all pumpable liquids removed from the tanks, all abandoned equipment removed, data recorded electronically, all potential openings sealed, automated surveillance operations installed, and surface contamination cleaned up.

Waste Tank Safety Issues

The Waste Tank Safety Program, now called Safety Issue Resolution Projects, was established in 1990 to address the hazards associated with storage of radioactive mixed waste in the 177 large underground storage tanks at the Hanford Site. The projects serve as the focal point for identification and resolution of selected high-priority waste tank safety issues, with resolutions being completed in priority order. Tanks with the highest risk are being evaluated and mitigated first. The tasks to resolve safety issues are planned and implemented in the following logic sequence: 1) evaluate and define the associated safety issue, 2) identify and close any associated unreviewed safety questions (DOE 1991), 3) mitigate any hazardous conditions to ensure safe storage of the waste, 4) monitor waste storage conditions, and 5) resolve the respective safety issues. Each of these steps has supporting functions of some combination of monitoring, mathematical analyses, laboratory studies, and in-tank sampling or testing. The path followed depends on whether the waste requires treatment or can be stored safely by implementing strict controls.

Safety Issue Resolution Projects is currently focusing on resolution of ferrocyanide, flammable gas, organic, high-heat, noxious vapor, and criticality safety issues as described below. The tanks of concern are placed on a Watch List and categorized by safety issue. At the end of 1996, there were 38 tanks on the Watch List: 25 flammable gas tanks, 20 organic tanks, and 1 high-heat tank (some of the tanks are included under more than one category). These tanks were identified in accordance with the Defense Authorization Act, Section 3137, "Safety Measures for Waste Tanks at Hanford Nuclear Reservation" (1990). In 1996, all 18 ferrocyanide tanks were removed from the Watch List, and the issue was deemed resolved by DOE and the Defense Nuclear Facilities Safety Board.

Watch List Tanks

In early 1991, all Hanford Site high-level waste tanks were evaluated and organized into categories to ensure increased attention and monitoring. Other safety concerns, including the possibility of nuclear criticality in a waste tank, have also been addressed.

Ferrocyanide. The ferrocyanide safety issue, which was an earlier concern, involved the potential for uncontrolled exothermic reactions of ferrocyanide and nitrate/nitrite mixtures (Postma et al. 1994a). If ferrocyanide is present, laboratory studies have shown that temperatures must exceed 250°C (482°F) for a reaction to propagate. The hottest temperature in ferrocyanide tanks formerly on the Watch List is 53°C (127°F) and decreasing. In October 1990, an unreviewed safety question was declared for the former ferrocyanide tanks because safety was not adequately defined by existing analyses. However, the unreviewed safety question was closed by DOE in March 1994 as a result of significant knowledge gained from simulant studies, conservative theoretical analyses, and analyses of actual waste samples that allowed bounding

safety criteria to be defined and applied to each tank (Postma et al. 1994a). There were originally 24 ferrocyanide tanks on the Watch List: 4 were removed in 1993, 2 in 1994, 4 in June 1996, and 14 in September 1996. The ferrocyanide levels have decreased by at least 90%, and in some cases by 99%, over those originally added to the tanks. Experimental studies (Lilga et al. 1996) and core samples from 10 of the ferrocyanide tanks show that hydrolysis and radiolysis of the ferrocyanide occurred and sufficient fuel to be of concern is no longer present (Meacham et al. 1996a). DOE approved resolution of the ferrocyanide safety issue in December 1996.

Flammable Gas. The flammable gas safety issue involves the generation, retention, and potential release of flammable gases by the waste. Previously, 25 tanks were identified and placed on the Watch List. In prior years, work controls were instituted to prevent introduction of spark sources into these tanks, and evaluations were completed to ensure that installed equipment was intrinsically safe.

The worst-case tank (241-SY-101) was successfully mitigated in 1994 with the installation of a mixing pump. The pump is operated up to three times a week to mix the waste and release gases that are generated and retained in the waste. This mitigation technique has been completely successful, and no episodic releases of gas have occurred since the pump was installed. Two spare mixer pumps are available in the event the original pump should fail.

Hydrogen monitors have been installed on all 25 flammable gas tanks. These monitors, called standard hydrogen monitoring systems, consist of a cabinet equipped with piping and instrumentation that support an on-line hydrogen detector and a "grab" sampler. Documentation to close the unreviewed safety question for the SY Tank Farm was submitted to DOE in 1995 for closure action. Approval for tank 241-SY-101 to be removed from the unreviewed safety question list was received in June 1996. In November 1996, the unreviewed safety question for the other tanks was expanded to cover 176 underground waste tanks (241-SY-101 is not included) and all auxiliary tank farm tanks. Standard hydrogen monitoring systems are being added to a number of these waste tanks.

Additional instrumentation for determining waste properties and tank behavior has been developed for use in the flammable gas tanks. These instruments include viscometers for measuring the viscosity of the waste in the tanks, in-tank void fraction meters that determine the amount of gas in a given volume of waste, retained gas samplers that capture a waste sample in a gas-tight chamber and allows the gas composition and volume to be measured after the apparatus is brought into a hot cell, and gas characterization systems that allow a broad spectrum of dome-space gases (including hydrogen, ammonia, and nitrous oxide) to be continuously monitored in selected tanks. All of these devices became operational in 1996.

In November 1996, more stringent flammable gas controls were placed on all 177 high-level waste storage tanks after several events occurred where hydrogen gas was found at significant levels in a waste tank undergoing interim stabilization and in another tank being core sampled. All rotary-mode sampling using the sampling trucks was suspended until a safety assessment covering this method is approved for tanks because they might be retaining pockets of gas within the waste matrix.

The Tri-Party Agreement milestone for resolution of the flammable gas safety issue is scheduled for September 2001.

High-Heat Tank. This safety issue concerns tank 241-C-106, a single-shell tank that requires water additions and forced ventilation for evaporative cooling. Without the water additions, which would have to be severely restricted in the event of a tank leak, the tank could exceed structural temperature limits, resulting in potential concrete degradation and possible tank collapse. This tank is scheduled for retrieval, starting in 1998, and transfer of the waste to a double-shell tank. Double-shell tanks are designed to better handle heat-bearing materials than single-shell tanks. As part of the retrieval program, a refrigerated chiller system has been installed to remove radioactive decay heat and the heat generated by the waste transfer pumps. The chiller is scheduled to come on-line in 1997.

The Tri-Party Agreement milestone for resolution of the high-heat safety issue is scheduled for September 2001, with an interim milestone to start retrieval of the waste in tank 241-C-106 by October 1997. This interim milestone is being renegotiated to start sluicing in September 1998.

Organic Tanks. The organic tanks safety issue involves the potential for uncontrolled exothermic reactions of organic chemicals and nitrates/nitrites or organic solvents also present in some of the tanks. During 1995, as part of the vapor sampling program, it was shown that organic vapors in the organic tanks are too low in concentration to exceed even 25% of their lower flammability limits. Criteria to screen tanks for possible organic

compounds were also established based on analyses and simulant testing. Tank waste was screened against these criteria, using historic and recent sampling data (Meacham et al. 1996b). Concentrations and temperatures required to support propagating exothermic reactions are comparable to those for ferrocyanide (Fauske et al. 1995). In addition, moisture levels of 20 weight percent, and less in some cases, will prevent reactions from propagating regardless of the fuel concentration. To determine if adequate moisture is present in the waste, special surface monitoring instrumentation is being developed, and full-depth core sampling of waste in organic tanks is continuing.

Work controls were implemented in 1990 to prevent the introduction of ignition sources into these tanks. In May 1994, vapor sampling and safety analyses were completed that provided the technical basis for closing the unreviewed safety question on the flammability of the floating organic layer in tank 241-C-103 (Postma et al. 1994b). Ten tanks that contained organic complexants were added to the Watch List following a review of sampling data and waste transfer records (Hanlon 1994).

Other work indicates that aging processes have destroyed or significantly lowered the energy content of the organic tanks (Ashby et al. 1994, Meacham et al. 1996b), making them less hazardous. In addition, work by Barney (1996) shows that most organic complexants used during nuclear fuel reprocessing at the Hanford Site and the primary degradation products of tributyl phosphate are water soluble in nitrate/nitrite salt solutions. Thus, a high percentage of reactive organic chemicals are removed from the single-shell tanks when their pumpable liquid supernatant is pumped out as part of the interim stabilization process for the single-shell tanks.

During 1995 and 1996, waste samples from the organic tanks were taken to determine the quantities of organic constituents present in each tank. Most of the organics found have been of low energy. None of the samples show any tendency to propagate when tested in a special tube propagation calorimeter (Fauske 1996a, 1996b). Tank characterization reports have been or are being prepared for each of the sampling events. The Tri-Party Agreement milestone for resolution of the organic tanks safety issue is scheduled for September 2001.

Criticality. The unreviewed safety question on the potential for criticality in the high-level waste tanks was closed in 1994 by completing additional analyses, strengthening tank criticality prevention controls, and improving administrative procedures and training (Braun and Szendre 1994). In 1996, an extensive effort was put forth to provide the technical basis for resolving the criticality safety issue. Technical studies were completed that showed a criticality event within a high-level waste tank is not likely during storage (Bratzel et al. 1996). All of the single- and double-shell tanks at the Hanford Site contain sufficient neutron absorbers to ensure safe storage; however, additional sampling and controls will be required for retrieval- and pretreatment-related activities. A potential criticality safety issue still remains for waste transfers required as part of the retrieval and pretreatment processes. A request to close the criticality safety issue was forwarded to DOE for approval in September 1996. It is expected to be approved during 1997. The Tri-Party Agreement milestone for resolution of the criticality safety issue is scheduled for September 1999.

Vadose Zone Characterization Near Single-Shell Underground Waste Storage Tanks

DOE Grand Junction Office has been tasked with performing a baseline characterization of the vadose zone beneath the single-shell underground waste storage tanks at Hanford. The contractor performing this work for the Grand Junction Office is MACTEC-ERS (formerly Rust Geotech, Inc.). This characterization work is being accomplished in an effort to comply with Resource Conservation and Recovery Act requirements to identify contamination sources and to determine the nature and extent of the contamination under the single-shell tanks.

The characterization program involves establishing a baseline of contaminant distribution by assaying the gamma-emitting radionuclides in the vadose zone (i.e., the vadose zone consists of the unsaturated sediment between the ground surface and the groundwater table). The assays are performed by logging the existing boreholes surrounding the tanks with spectral gamma ray logging systems. The assays identify the current baseline conditions in terms of the nature and extent of the gamma-emitting radionuclides. The baseline study provides a basic understanding of contaminant distribution from which comprehensive characterization programs can be developed and it provides a baseline from which to compare future monitoring data to identify changes.

The characterization program began in 1995 and by the end of 1996, 490 boreholes surrounding 86 tanks had been logged out of a total of 750 boreholes surrounding

134 tanks. The log data were analyzed and a tank summary data report was prepared for each tank. On completion of the data reports for each tank, a more comprehensive tank farm report will be prepared that will correlate the vadose zone information throughout the tank farm.

In 1996, the remaining four tank summary data reports for the SX Tank Farm in the 200-West Area were completed (the first nine data reports were completed in 1995). Also in 1996, all 12 tank summary data reports were completed for the BY Tank Farm in the 200-East Area, and all 12 data reports were completed for the U Tank Farm in the 200-West Area. Finally, 6 of the 18 data reports were completed for tanks in the TX Tank Farm. The first tank farm report (the SX Tank Farm) was also published in 1996.

Information from the SX Tank Farm produced in 1995 showed cesium-137 contamination from the tanks was deeper in the vadose zone than was previously expected. Cesium-137 was found as deep as 38 m (125 ft) at some locations. This is the depth of many of the SX Tank Farm monitoring boreholes; therefore, the maximum depth of the cesium-137 contamination migration could not be determined. Previous computer models predicted cesium-137 would stay within a few meters (feet) of the base of the tanks and would not move deep into the vadose zone. Therefore, questions were raised as to whether the contamination was deposited deep in the vadose zone by transport through the sediment or if it traveled along unsealed boreholes.

Also, as a part of the vadose zone characterization at the SX Tank Farm, questions were raised about the source of a technetium-99 plume in the groundwater beneath the tanks. An extensive investigation of the groundwater data was conducted by Hanford personnel and it was determined that the S and SX Tank Farm complex was the source of the groundwater contamination. This was later confirmed in an independent investigation by the Washington State Department of Ecology. As a result, a groundwater assessment order was issued by the Washington State Department of Ecology for the S and SX Tank Farm complex and a groundwater assessment plan was prepared. The assessment is ongoing.

To help resolve questions raised by the vadose zone characterization findings, DOE formed an independent panel of experts to review the data and recommend a course of action to confirm or refute the findings of the vadose zone characterization program. Under the guidance of the independent panel, two new boreholes were drilled in the SX Tank Farm.

The boreholes were drilled with a percussion hammer drilling method. The first borehole showed contamination drag-down from the drilling operation had occurred and it did not intercept a large plume of contamination as expected. For the second borehole, the drill stem was modified to minimize contamination drag-down during drilling, and drag-down did not occur. This borehole intercepted relatively high levels of contamination to total depth at 40 m (130 ft), confirming the presence of cesium-137. This also confirmed that the contamination moved through the formation to the deep vadose zone, and the borehole pathway was not the cause for the deep contamination migration.

Finally, as a part of the vadose zone investigation, four tanks in the SX Tank Farm were reevaluated to reassess the volume of contamination that leaked from the tanks. The new leak estimates were at least an order of magnitude higher than the original leak estimates, demonstrating a need for additional investigation at all single-shell tanks.

In summary, the new data obtained under the vadose zone characterization program has identified that, in some cases, the groundwater has been impacted by tank leaks. Improved contaminant transport models calibrated with the new data will help to better define the nature and extent of contamination.

For a more comprehensive description of the single-shell tank vadose zone characterization program, the results of that program for 1996, and references to detailed reports, the reader is referred to Section 3.3, “Vadose Zone Characterization and Monitoring.”

Waste Immobilization

Approximately 215 million L (55 million gal) of radioactive and hazardous wastes accumulated from over 40 years of plutonium production operations are stored in 149 underground single-shell tanks and 28 underground double-shell tanks. Current plans are to pretreat the waste and then solidify it into a glass matrix. Pretreatment will separate the waste into a low-radioactivity fraction and a high-radioactivity, including transuranic, fraction. The bulk of the radionuclides will then be in the high-radioactivity and transuranic fraction. In separate facilities, both fractions will be vitrified, a process

that will destroy or extract organic constituents, neutralize or deactivate dangerous waste characteristics, and immobilize toxic metals. The immobilized low-radioactivity fraction will be disposed of in a near-surface facility on the Hanford Site in a retrievable form. The immobilized high-radioactivity fraction will be stored onsite until a geologic repository is available offsite for permanent disposal. Tri-Party Agreement milestones specify December 2028 for completion of pretreatment and immobilization of the tank wastes.

During 1996, a change request was approved changing Tri-Party Agreement milestones to allow DOE to proceed with the planned privatization of the initial pretreatment and immobilization function of the Tank Waste Remediation System program. DOE and private companies are unwilling to commit immediately to full-scale facilities on a fixed-price basis because of uncertainties with the waste characteristics, the effectiveness of the technology, and the basis for accepting the deliverables. Consequently, the approach to privatization will be conducted in two phases.

The first phase will be a proof-of-concept/commercial demonstration phase. This phase will involve pretreatment and vitrification of the low-level waste. High-level waste separated in the pretreatment process would either be stored on an interim basis until sufficient quantities are collected to make it cost effective to process or vitrified as an option in this phase. This phase would select multiple contractors to design and obtain permits for facilities. The objectives of this phase are to 1) demonstrate technologies and processes in a production-level environment; 2) treat and immobilize sufficient waste to demonstrate early progress in remediating the tank situation to the stakeholders; 3) better understand the costs, risks, and benefits of a fixed-price privatization framework; 4) ascertain the financial viability of the private marketplace to accomplish the Tank Waste Remediation System mission; 5) establish conditions for DOE to be a “smart buyer” and for private industry to be a “smart provider” of treated waste products for Phase II; and 6) to balance the private vendors’ objectives with DOE’s objectives.

Phase I will be divided into subphases. Part A is a 20-month period used to establish the technical, operational, regulatory, and financial elements required by the contractors to provide waste treatment services at fixed unit prices. During this period, DOE will determine whether to authorize the contractor to perform Part B. Part B is a 10- to 14-year period established to provide waste treatment services in privatized facilities. DOE will order a minimum quantity of waste treatment services during this phase and may provide additional orders.

The second phase will be the full-scale production phase. Facilities will be sized so all of the remaining waste can be processed and immobilized on a schedule that will accommodate removing the waste in single-shell tanks by 2018. Objectives of the full-scale production phase are to 1) implement the lessons learned from Phase I; 2) process all tank waste into forms suitable for final disposal while meeting environmental, health, and safety requirements to achieve process competition and cost savings throughout the phase; 3) meet or exceed the Tri-Party Agreement benchmark performance milestones; and 4) balance the private vendor’s objectives with DOE’s objectives. At the end of any contract, the contractor will deactivate all contractor-provided facilities.

During 1996, DOE issued a contract to two private firms to start work on Phase I, Part A. The two firms are British Nuclear Fuels Ltd. and Lockheed Martin Advanced Environmental Systems.

Solid Waste Management Activities

Waste Receiving and Processing Facility

During 1994, construction was started on the first major solid waste processing facility associated with cleanup of the Hanford Site. Having started operations in March 1997, the Waste Receiving and Processing Facility Module 1 is staffed to analyze, characterize, and prepare drums and boxes for disposal of waste resulting from plutonium operations at Hanford. The Tri-Party Agreement mandates construction and operation of this module. Wastes destined for the Waste Receiving and Processing Facility include Hanford’s current inventory of more than 37,000 drums of stored waste as well as materials generated by future site cleanup activities across the DOE complex. Consisting primarily of clothing, gloves, face masks, small tools, and particulates suspected of being contaminated with plutonium, waste containers may also contain other radioactive materials and hazardous components. Processed waste that qualifies as low-level waste and meets disposal requirements will be buried directly at the Hanford Site. Low-level waste not meeting burial requirements will be

treated in the Waste Receiving and Processing Facility to meet the requirements or will be prepared for future treatment at other onsite or offsite treatment, storage, and disposal facilities. Waste determined in the facility to be transuranic will be certified and packaged for shipment to the Waste Isolation Pilot Plant, Carlsbad, New Mexico for permanent storage. Materials requiring further processing to meet disposal criteria will be retained at Hanford pending treatment.

The 4,831-m^2 (52,000-ft^2) facility began operations in March 1997 near the Central Waste Complex in the 200-West Area. The 200-West Area is located on the central plateau that the public and Tri-Party agencies have designated for waste processing and long-term waste storage. The facility is designed to process approximately 6,800 drums of waste annually for 30 years.

Radioactive Mixed Waste Disposal Facilities

The Radioactive Mixed Waste Disposal Facilities are the first in DOE's national complex for disposal of radioactive mixed wastes. These facilities are located in the low-level burial grounds in the 200-West Area and are designated Trench 218-W-5, Trench 31, and Trench 34. Construction was completed on Trench 34, and operational readiness was completed on both trenches in 1995. The facilities were not in use in 1996. The facilities consist of rectangular landfills with approximate base dimensions of 76 by 30 m (250 by 100 ft). The bottom of the landfill excavations slope slightly, giving a variable depth of 9 to 12 m (30 to 40 ft).

These facilities are designed to comply with Resource Conservation and Recovery Act requirements–double liners and leachate collection and removal systems. The bottom and sides of the facilities are covered with a 1-m-(3-ft-) deep layer of soil to protect the liner system during fill operations. There is a recessed section at one end of the landfill excavations that houses the sumps for leachate collection. Access to the bottom of the landfills is provided by ramps along the perimeters.

Enhanced Radioactive Mixed Waste Storage Facility, Phase V

Construction was initiated on the Enhanced Radioactive Mixed Waste Storage Facility, Phase V to increase the site's permitted mixed waste storage capacity and to provide interim storage for the Waste Receiving and Processing Facility planned to begin operations in June 1997. This facility comprises three buildings that have a total storage capacity of approximately 2,800 m^3 (3,700 yd^3). The project is currently going through the operational readiness review process. The facility will be operated under the Central Waste Complex interim safety basis that was approved by DOE in March 1997.

T Plant Complex

The function of the T Plant complex in the 200-West Area is to provide waste processing and decontamination services for the Hanford Site. Two facilities are used to provide these services: the T Plant canyon and 2706-T. Other areas around these facilities are also used to support these services. The T Plant complex is a Resource Conservation and Recovery Act-permitted facility, which can store waste for greater than 90 days and perform treatment in tanks and other containers. T Plant's waste handling activities in 1996 included the following:

- performing verification of wastes being shipped to solid waste facilities for storage or disposal
- repackaging and/or sampling waste to meet solid waste acceptance criteria or to determine acceptability of waste for treatment
- treating dangerous and mixed wastes to meet Resource Conservation and Recovery Act requirements for land disposal
- decontaminating equipment to allow for reuse or disposal as waste.

Plans for upgrading the T Plant liquid waste storage tank system were finalized in 1996. These upgrades will make T Plant's tank system fully compliant with the regulations and will allow for improved liquid waste handling capabilities. Construction started in January 1997 with completion expected by September 1999.

Thermal Treatment Contracts

In an effort to involve the private sector in waste treatment activities on the site, bids were solicited for processing stored and future generated solid waste that requires thermal treatment per Resource Conservation and Recovery Act regulations. In October 1995, the contract for this

work was awarded to Allied Technology Group Corporation. The contract is for 5 years, with five 1-year renewal options. Waste processing is scheduled to begin in fiscal year 2001.

Two additional requests for proposals for thermal treatment of waste were issued in April 1997. One defines the requirements for treating nondebris inorganic mixed waste during fiscal year 1998 with an option for additional treatment during fiscal year 1999. The other covers treatment of mixed waste debris during fiscal year 1999 with options for additional treatment in fiscal years 2000 and 2001. Treatment contractors may propose treatment at facilities on their site or may propose to install portable/temporary facilities on the Hanford Site. Contract award is planned for September 1997.

Navy Reactor Compartments

Seven defueled United States Navy reactor compartment disposal packages were received and placed in Trench 94 in the 200-East Area during 1996. This brings the total number received to 61. The compartments originate from decommissioned nuclear-powered submarines.

The reactor compartment disposal packages are being regulated by Washington State as dangerous waste because of the presence of lead used as shielding and by EPA because of the presence of small amounts of polychlorinated biphenyls tightly bound within the composition of solid materials such as thermal insulation, cable coverings, and rubber. Also, the compartments are regulated as mixed waste because of radioactivity in addition to dangerous waste.

325 Building Hazardous Waste Treatment Units

The 325 Building hazardous waste treatment units in the 300 Area receive, store, and treat mixed and dangerous waste generated by Pacific Northwest National Laboratory programs. The units consist of the Shielded Analytical Laboratory and the Hazardous Waste Treatment Unit.

The Shielded Analytical Laboratory is a facility that has a dual role as an analytical laboratory and a treatment facility. The laboratory performs tank treatment and bench-scale treatment of high dose rate laboratory waste (2,000 rem/h capability).

The Hazardous Waste Treatment Unit is a treatment facility that contains fume hoods and gloveboxes for mixed waste treatment. The unit performs bench-scale treatment of mixed and dangerous waste from various Pacific Northwest National Laboratory programs and also treats transuranic and transuranic mixed waste by neutralization and stabilization.

These units are currently operating under interim-status conditions. Final status is expected in December 1997.

Liquid Effluent Activities

242-A Evaporator

Available storage space to support remediation of the tank waste and cleanup of the Hanford Site is limited in the double-shell tanks. The 242-A Evaporator in the 200-East Area processes double-shell tank waste into a concentrate (that is returned to the tanks) and a process condensate stream. The evaporator had one processing campaign in 1996. Dilute waste from the double-shell tanks was processed, resulting in an average waste volume reduction of 88.5% while producing 4.8 million L (1.3 million gal) of process condensate. Two campaigns are scheduled for 1997.

Effluent treatment and disposal capabilities are available to support the continued operation of the evaporator. The 200 Areas Effluent Treatment Facility near the 200-East Area was constructed to treat the process condensate. The process condensate is temporarily stored in the Liquid Effluent Retention Facility while awaiting treatment in the 200 Areas Effluent Treatment Facility. Cooling water and nonradioactive steam condensate from the evaporator will be discharged to the 200 Areas Treated Effluent Disposal Facility starting in 1997.

Liquid Effluent Retention Facility

The Liquid Effluent Retention Facility consists of three Resource Conservation and Recovery Act-compliant surface impoundments for storing process condensate from the 242-A Evaporator. The facility provides equalization of the flow and pH of the feed to the 200 Areas Effluent Treatment Facility. Each basin has a capacity of 24.6 million L (6.5 million gal). Spare capacity equal to the volume of one basin is reserved as contingency in the event a leak develops in an operational basin. The basins

are constructed of two, flexible, high-density, polyethylene membrane liners. A system is provided to detect, collect, and remove leachate from between the primary and secondary liners. Beneath the secondary liner is a 0.9-m- (3.0-ft-) thick soil/bentonite barrier should the primary and secondary liners fail. Each basin has a mechanically tensioned floating membrane cover constructed of very low-density polyethylene to keep out unwanted material and to minimize evaporation of the basin contents. The facility began operation in April 1994 and is designed to operate for 20 years. A total of 5.3 million L (1.4 million gal) of process condensate was stored in the basins at the end of 1996.

200 Areas Effluent Treatment Facility

The 200 Areas Effluent Treatment Facility (near the 200-East Area) provides for 1) collection of liquid effluents, 2) a treatment system to reduce concentrations of radioactive and hazardous waste constituents in the effluent streams to acceptable levels, 3) tanks to allow for verification of treated effluent characteristics before discharge, and 4) a state-approved land disposal structure for effluent disposal. The treatment process constitutes best available technology and includes filtration, ultraviolet light/peroxide destruction of organic compounds, reverse osmosis to remove dissolved solids, and ion exchange to remove the last traces of contaminants. Treatment capacity of the facility is 570 L/min (150 gal/min). The facility began operation in December 1995 and has a 30-year design life. Approximately 37.5 million L (9.9 million gal) of waste water were treated in 1996.

The treated effluent from this facility is sampled to verify that the concentrations of radioactive and hazardous waste constituents have been reduced to acceptable levels, then discharged via a dedicated pipeline to a state-approved land disposal structure. The disposal facility (200-West Area) consists of an underground drain field. The percolation rates for the field have been established by site testing and evaluation of soil characteristics. Tritium in the liquid effluent cannot be practically removed, and the location of the disposal facility maximizes the time for migration to the Columbia River to allow for radioactive decay. A delisting petition was approved by the EPA that exempts the treated process condensate from the requirements of dangerous waste regulations under the Resource Conservation and Recovery Act and imposes certain effluent quality restrictions. High concentrations of ammonia in the process condensate also make this feed stream a dangerous waste subject to WAC 173-303. After treatment in the facility, the discharged effluent is not a dangerous waste. The disposal facility was permitted in June 1995 by the Washington State Department of Ecology under WAC 173-216. The discharge permit requires monitoring of the effluent groundwater to ensure that concentrations for certain constituents are not exceeded.

Secondary waste from treating the process condensate is a low-level mixed waste that will be concentrated, dried, and packaged in 208-L (55-gal) drums. The 200 Areas Effluent Treatment Facility is a Resource Conservation and Recovery Act-permitted storage facility, and this secondary waste material is temporarily stored until it is transferred to the Central Waste Complex for subsequent treatment (if needed to meet land disposal restriction treatment standards) and disposal in mixed waste trench 218-W-5 in the 200-West Area.

200 Areas Treated Effluent Disposal Facility

The 200 Areas Treated Effluent Disposal Facility is a collection and disposal system for non-Resource Conservation and Recovery Act-permitted waste streams that already meet discharge requirements. Implementation of regulatory required “best available technology/all known and reasonable treatment” is the responsibility of the generating facilities. Facilities that discharge to this facility currently include the Plutonium Finishing Plant, 222-S Laboratory, T Plant, 284-W Power Plant, Plutonium-Uranium Extraction Plant, B Plant, and 242-A-81 Water Services Building. Each facility must comply with discharge limits in WAC 173-216 without further treatment.

This facility began operation in April 1995 and is designed to operate for 30 years. The design capacity of the facility is 8,700 L/min (2,300 gal/min), though the discharge permit presently limits the average monthly flow to 2,400 L/min (640 gal/min). Approximately 760 million L (200 million gal) of treated effluent were discharged in 1996. The effluent is discharged to two 2-ha (5-acre) disposal ponds located east of the 200-East Area. The discharge permit requires monitoring of the effluent groundwater to ensure that concentrations for certain constituents are not exceeded.

300 Area Treated Effluent Disposal Facility

Waste water from laboratories, research facilities, office buildings, and former fuel fabrication facilities in the 300 Area is treated in the 300 Area Treated Effluent

Disposal Facility. The waste water consists of once-through cooling water, steam condensate, and other liquid wastes generated in noncontact radioactive processes. The laboratory services are particularly critical to Hanford Site cleanup activities, including tank waste remediation efforts.

This facility is designed for continuous receipt of waste waters, with a storage capacity of up to 5 days at the design flow rate of 1,100 L/min (300 gal/min). The facility treats the waste water using best available technology. The treatment process includes iron coprecipitation to remove heavy metals, resin ion exchange to remove mercury, and ultraviolet light/hydrogen peroxide oxidation to destroy organics and cyanide. Sludge from the iron coprecipitation process is dewatered and used for backfill. The treated liquid effluent is monitored and discharged through an outfall to the Columbia River under a National Pollutant Discharge Elimination System permit. Capability exists to divert the treated effluent to holding tanks before discharge, if needed, until a determination can be made for final disposal based on sampling. This facility began operating in December 1994 and treated approximately 350 million L (92 million gal) of waste water in 1996.

340 Waste Handling Facility

The 340 Waste Handling Facility provides receipt, storage, and loadout capability for low-level liquid waste generated during laboratory operations in the 300 Area. The waste is accumulated and stored in two 57,000-L (15,000-gal) tanks located in a covered, below-grade vault in the 340 Building. Six additional 30,000-L (8,000-gal) tanks in the adjacent 340-A Building provide backup storage capability. The accumulated waste is pumped into railcars and transported to the 200-East Area 204-AR Unloading Facility for neutralization and transfer to double-shell tanks for storage. The 340 facility does not have a Resource Conservation and Recovery Act permit for storage; therefore, wastes cannot be stored for more than 90 days.

The 340 facility will cease receiving waste in September 1998. A new waste handling facility with storage and truck loadout capability will be provided. The 340 facility will then be cleaned, decontaminated, and decommissioned.

300 Area Process Sewer Upgrades

Upgrades to the 300 Area process sewer system were completed in 1996. A proposal to reline the existing piping was approved by the regulators. The process involved camera surveillance and cleanout of the piping, installation of resin-impregnated polyester felt fiber in the pipe walls, and thermal curing by heating the water. Lateral pipelines were cut using robotics, and new access holes and cleanouts were constructed as needed. Additional process sewer lines and storm-water connections were installed. The existing pump station, which serves buildings in the southeastern 300 Area, was refurbished. Drummed residue from pipe cleanout was sent to disposal.

The process sewer system collects cooling water, steam condensate, and other liquid effluents generated in 300 Area laboratories, research facilities, and office buildings. The waste water is treated in the 300 Area Treated Effluent Disposal Facility.

Phase II Liquid Effluent Streams

DOE has committed to implement "best available technology/all known and reasonable treatment" for nine waste-water streams and to permit the streams under WAC 173-216 by October 1997. This activity is required by the Washington State Department of Ecology Consent Order #DE 91NM-177 and Tri-Party Agreement Milestone M-17-00B and includes the elimination, minimization, or treatment of effluents being discharged to the 216-B-3 Expansion Ponds in the 200-East Area.

Project W-252, "Phase II Effluent Treatment and Disposal," will connect the following streams to the 200 Areas Treated Effluent Disposal Facility: 242-A Evaporator cooling water, 242-A Evaporator steam condensate, 284-E Power Plant waste water (including 282-E and 283-E), and B Plant/Waste Encapsulation Storage Facility cooling water. Another stream, the 241-A Tank Farm cooling water, is to be connected to the 200 Areas Treated Effluent Disposal Facility as part of Project W-030. Construction on Project W-252 is scheduled to be completed in April 1997 and startup is planned for June 1997. A supplemental discharge permit application was submitted in November 1996 so that additional streams can be disposed of to the 200 Areas Treated Effluent Disposal Facility. The permitted capacity of the facility will increase to a total average yearly flow rate of 4,540 L/min (1,200 gal/min) and a total average monthly flow rate of 12,900 L/min (3,400 gal/min).

Miscellaneous Streams

Miscellaneous streams are lower priority waste-water streams that discharge to the soil column throughout the Hanford Site and are subject to requirements in

Washington State Department of Ecology Consent Order #DE 91NM-177. The *Plan and Schedule for Disposition and Regulatory Compliance for Miscellaneous Streams* (DOE 1994d) was approved by the Washington State Department of Ecology in February 1995. This document provides a plan and schedule for ensuring that miscellaneous streams will be in compliance with the applicable state regulations (e.g., WAC 173-216 and 173-218). The commitments established in the plan and schedule include annually updating the miscellaneous streams inventory (through 1998), registering injection wells, submitting categorical permit applications, and implementing best management practices.

The inventory of miscellaneous streams includes more than 640 streams. Streams that already have discharge permits in place, streams for which permit applications have been submitted, or streams that are covered under a National Pollutant Discharge Elimination System permit are not included. All injection wells were registered under WAC 173-218 in August 1995, including injection wells that were previously registered. This ensured that the registrations were current, complete, and in the same format.

Use of categorical permits provides a vehicle to easily permit miscellaneous streams with similar characteristics. Categorical permit applications are to be submitted for the following:

- hydrotesting, maintenance, and construction discharges (application submitted November 1995)
- cooling water discharges and uncontaminated steam condensate (application submitted September 1996)
- storm-water discharges.

Another categorical permit was planned for surface-water and safety shower discharges. These streams will be included in an existing permit or eliminated. A best management practices report was submitted to the Washington State Department of Ecology in August 1996 and included recommendations of preferred options and an implementation schedule.

Revegetation and Mitigation Planning

DOE and the Hanford Natural Resource Trustees are working cooperatively to plan and provide effective input to restoration and mitigation actions for the proposed remediation sites. The contributors are supporting DOE in this effort. Revegetation/mitigation plans will include the use of native plant species (seeds and shrubs) as appropriate to restore the areas disturbed by remediation activities.

DOE Richland Operations Office and the environmental restoration contractor work cooperatively with the Natural Resource Trustees on the mitigation action plans for the various remedial action projects. The plans describe the planning and implementation of appropriate mitigation measures for areas disturbed during remediation. Mitigation measures include avoidance, minimization, rectification, or compensation of impacted resources.

The *Hanford Site Biological Resources Management Plan* (DOE 1996f) was developed to provide DOE and its contractors with a consistent approach to protect biological resources and monitor, assess, and mitigate impacts to them from site development and environmental cleanup and restoration activities. This comprehensive plan provides a framework to enable Hanford Site resource professionals to effectively fulfill their responsibilities and address tribal, resource agency, and other stakeholder concerns about the site's biological resources. The policies and guidelines described in the plan were developed based on legal requirements and policy initiatives that direct an ecosystem management approach toward resources management.

The *Hanford Site Biological Resources Mitigation Strategy Plan* (DOE 1996g), containing strategy that is part of the broader biological resource policy contained in the biological resources management plan (DOE 1996f), is designed to aid DOE in balancing its primary missions of waste cleanup, technology development, and economic diversification with its stewardship responsibilities for the biological resources it administers. This biological resources mitigation strategy will help to ensure consistent and effective implementation of mitigation recommendations and requirements, ensure mitigation measures for biological resources meet the responsibilities of DOE under the law, enable Hanford Site development and cleanup projects to anticipate and plan for mitigation needs via early identification of mitigation requirements, and provide guidance to Hanford personnel in implementing mitigation in a cost-effective and timely manner.